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[54] **OPTICAL WEFT STOP MOTION FOR A WEAVING MACHINE**
5 Claims, 2 Drawing Figs.

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[50] Field of Search 139/273, 336, 353, 370, 371; 340/259; 250/219

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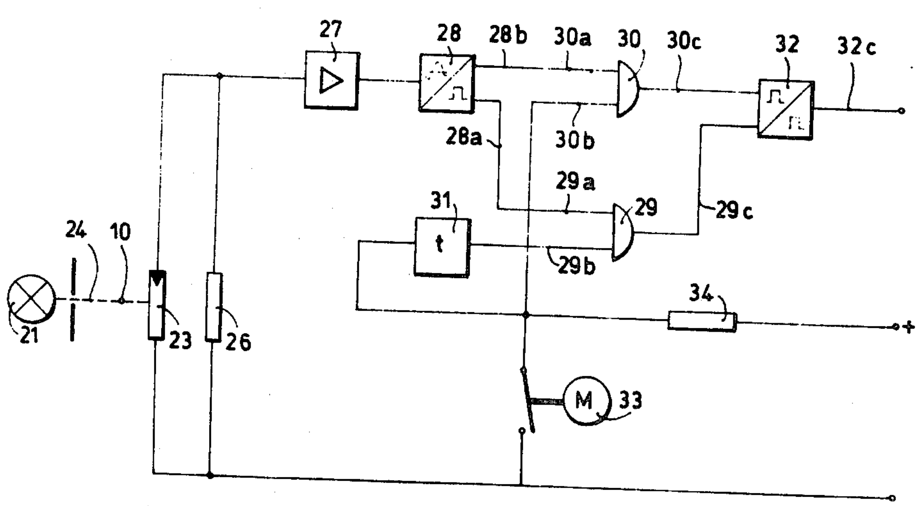
ABSTRACT: Upon occurrence of a weft yarn break the photocell is fully illuminated so that the Schmitt trigger is activated to change the state of the monostable multivibrator which thus deactivates the weaving machine. Further, in the absence of a weft yarn in the light path after picking, should the illumination of the photocell fall below a predetermined value, the voltage of the Schmitt trigger and a time network voltage are used to deactivate the weaving machine.



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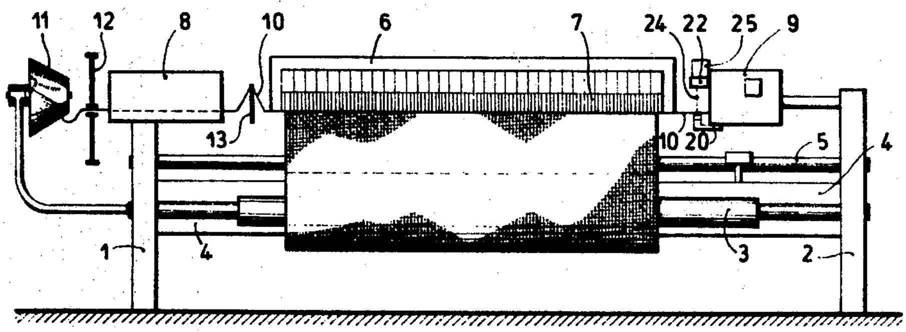

Fig.1

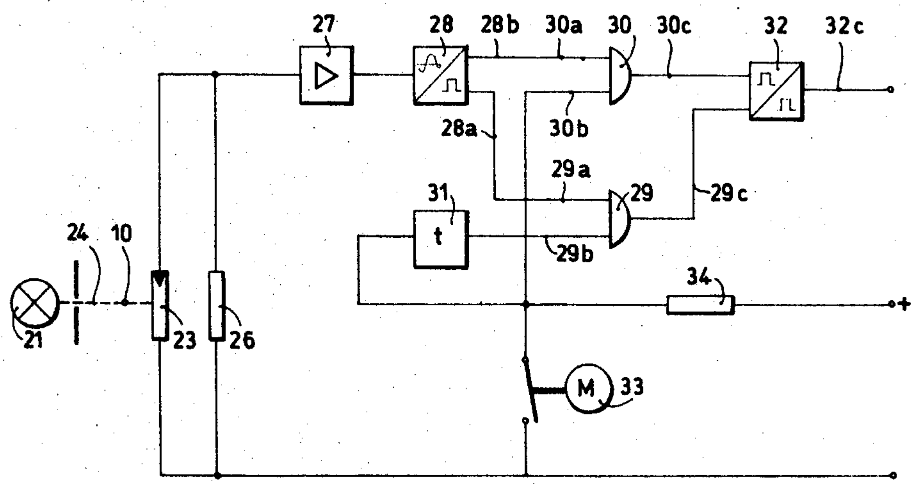

Fig.2

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OPTICAL WEFT STOP MOTION FOR A WEAVING MACHINE

This invention relates to an optical weft stop motion for a weaving machine.

Heretofore, it has been known to use optical means in order to detect the presence or absence of weft yarns in weaving machines. Generally, such means included a transmitter for emitting a beam of light transversely in the direction of the weft yarn towards a photoelectric cell situated behind the weft. In the event that a weft yarn was present, the beam was interrupted by the weft yarn so that the beam did not reach the photoelectric cell. Thus, the cell did not initiate any switching operations to stop the weaving machine.

However, experience has shown that the soiling of an optical weft yarn stop motion is a serious problem. For example, dust and fluff can settle on the optical parts, i.e. the lenses and the photosensitive element of the transmitter and receiver, such as to interfere with the beam of light. Also, lubricating oil adhering to the shuttle can settle in the form of a mist in mixture with dust on the optical parts. Experience has further shown that the intensity of the beam should have a relatively low value, and this is of course adjusted when the optical parts are clean. Consequently, when the transmitter and/or the receiver become dirty, the beam intensity operative in the receiver is so reduced that the receiver reacts as if a weft yarn had been introduced even if such is not the case. When fibrous yarns are being used, some of the fibers frequently work loose when the weft is inserted and may pass into the beam of the weft yarn stop motion and then also simulate the presence of a weft yarn. The monitoring of the weft yarn insertion by the weft yarn stop motion is thus no longer reliable and the weaving machine may therefore produce faulty fabric which goes unnoticed.

Accordingly, it is an object of the invention to reliably monitor the insertion of weft yarns without being obstructed by the inevitable fluff, oil mist and fibers.

It is another objection of the invention to be able to automatically switch off a weaving machine when the optical parts of an optical stop motion become excessively soiled.

Briefly, the invention provides an optical weft stop motion for a weaving machine which is not only capable of monitoring the presence of absence of a weft yarn during a picking operation in order to deactivate the weaving machine in the event of the absence of the weft yarn but also capable of determining the degree of soiling of the optical parts of the stop motion after a picking operation in order to deactivate the weaving machine in the event of excessive soiling. The optical weft stop motion can also determine the presence of a tangled yarn after a picking operation has been completed.

The optical weft stop motion includes a transmitter for emitting a beam of light in the direction of the path of a weft yarn and a receiver for receiving the beam. The receiver includes a switching means which causes the weaving machine to stop if no weft yarn is introduced. The switching means also initiates switching operations if the intensity of the beam acting on the receiver drops below a specified value. The advantage is that as soon as the optical parts have become so dirty that the weft yarn stop motion no longer operates reliably the weaving machine is stopped.

These and other objects of the invention will become more apparent from the following detailed description and the accompanied drawings in which:

FIG. 1 illustrates a general view of a weaving machine from the fabric end; and

FIG. 2 illustrates a circuit diagram of a weft yarn stop motion according to the invention.

Referring to FIG. 1, the weaving machine is constructed with two side plates 1, 2 between which are disposed a warp beam (not shown) a cloth beam 3, a guide and tensioning means (not shown) for the warp and fabric, a central member 4 connecting the two side plates 1, 2, and a main drive shaft 5 for the machine. In addition, a heddle shaft 6 forming part of a shedding mechanism and a reed 7 are mounted between the side plates 1, 2 as is known.

A picking mechanism 8 which projects a shuttle is mounted on the plate 1 while a catching mechanism 9 is disposed on the right-hand side of the machine as shown to receive the shuttle at the end of a picking (or inserting) operation. A weft yarn 10 is drawn from a feed bobbin 11, which is usually fixed outside the shed, through a screen 12 and a vertically movable yarn tensioning device 13 and introduced into the shed as is known.

After insertion of the weft yarn, the shuttle is pushed back slightly in the catching mechanism 9 so that it has exactly the same position on each pick. The yarn tensioning device 13 is moved into the top position in these conditions, so that the weft yarn always remains tensioned on the reverse movement of the shuttle. During the pushing back movement of the shuttle, yarn brakes (not shown) are used to ensure that the resulting detour at the yarn tensioning device 13 is formed mainly by pulling back the entire inserted weft yarn; where necessary, a length of yarn is also drawn off from the bobbin 11.

After the return movement of the shuttle and weft yarn, the weft yarn is cut off at the picking end by shears (not shown). The projecting weft yarn ends on each side of the shed are then tucked into the next shed by a selvedge forming mechanism (not shown) after the reed beat up and shedding. The fabric is then would on the cloth beam 3.

The optical weft stop motion includes a transmitter or light source 21 which is mounted in a casing 20 secured to the catching mechanism 9 beneath the picking line, i.e. the path theoretically covered by the shuttle and a photosensitive electric element or photoelectric cell 23 which is mounted in a casing 22 secured to the catching mechanism above the picking line. The transmitter serves to emit a concentrated beam 24 towards the photoelectric cell 23 transversely of the weft. The casing 22 further carries a box 25 containing an electric circuit of the weft stop motion.

Referring to FIG. 2, the electrical circuit of the weft stop motion includes a switching means for stopping the operation of the weaving machine. This circuit includes the photoelectric cell 23 which is connected via a resistor 26 to the input of an amplifier 27. The amplifier 27 is connected to a Schmitt trigger 28 which converts the amplified photoelectric cell voltage signal into a rectangular signal. The Schmitt trigger 28 has two outputs 28*a*, 28*b* which carry two voltages having a 180° phase shift. Whenever the Schmitt trigger 28 receives a voltage signal from the photoelectric cell 23 when the latter is fully illuminated, the state of the trigger changes and the phase of the voltage signals at the outputs change. The output 28*a* of the Schmitt trigger 28 is connected to an input 29*a* of a NAND gate 29, while the output 28*b* is connected to an input 30*a* of a second NAND gate 30. A second input 29*b* of the gate 29 is connected to a time network 31. The outputs 29*c* and 30*c* of the gates 29, 30 lead to a monostable multivibrator 32, whose output 32*c* is connected via amplifier elements (not shown) to the main switch (not shown) of the weaving machine. Another switch 33 is provided in the switching means and is controlled by the weaving machine main shaft 5. The switch 33, which is normally closed, enables a second input 30*b* of the gate 30 to be selectively connected to earth or, via a resistor 34, to a positive voltage.

In operation, in order to monitor the insertion of a weft yarn, as soon as the shuttle reaches the catching mechanism 9, the switch 33 is opened by the weaving machine main shaft 5. Consequently, the input 30*b* of the gate 30 is connected via resistor 34 to the positive voltage. However, the phase position of the output voltages of the Schmitt trigger 28 is such that the voltage at output 30*a* is not sufficient to allow the gate 30 to pass a signal together with the voltage at output 30*b*. If no weft yarn has been inserted by the shuttle, then there is no weft yarn in the path of the beam of light 24 between the light source 21 and the photoelectric cell 23. The cell 23 is thus fully illuminated and generates a voltage signal which, after amplification in the amplifier 27, actuates the Schmitt trigger 28. The phase of the signal at the input 30*a* of the gate 30 thus changes so that it is now sufficient with the voltage at input 30*b*, to enable the gate 30 to pass a signal to the monostable multivibrator **32**. The state of the multivibrator **32** thus changes and causes the weaving machine to stop by deactivating the main switch of the machine. The same processes occur if the weft yarn breaks, such breakage usually occurring just behind the shuttle. The weft yarn then forms a small loop near the beam of light, such loop bypassing the beam and acting as if no weft yarn had been inserted.

If a weft yarn **10** has been inserted by the shuttle, as is the case when the weaving machine is operating normally, the yarn will be situated in the path of the beam of light **24** so that the beam **24** does not reach the photoelectric cell **23** and the cell **23** does not produce a signal. The state of the Schmitt trigger **28** does not change and the phase of the voltage of the input **30***a* of the gate **30** does not change. Thus, the gate **30** does not pass a signal, the multivibrator **32** does not change over and does not initiate any switching operations to stop the weaving machine. The machine then continues to operate and, after being pushed back, the shuttle is ejected from the catching mechanism **9** (FIG. **1**) and returned to the picking mechanism **8** (FIG. **1**). The weft yarn is cut off followed by the beat up operation, shedding and tucking of the ends into the next shed to form the selvedge. Thus, there is reliably no weft yarn now situated in the region of the beam of light **24** between the transmitter **21** and receiver **23**. The optical parts of the weft yarn stop motion are at this time checked for soiling as follows:

Whenever the switch **33** is opened, the time network **31** is also started, receiving a positive voltage via the resistor **34**. The transit time, e.g. 120 milliseconds (msec.), of the time network **31** is longer than the opening time of the switch **33**, which closes after the insertion of the weft yarn has been monitored. That is, the transit time, which depends on the speed of operation of the weaving machine, is so long that the above-mentioned time for the optical parts to be checked is reached. At this time, the time network **31** delivers a voltage to the input **29***b* of the gate **29**. If the optical parts are so dirty that the intensity of the beam **24** of light reaching the photoelectric cell **23** is inadequate to deliver a voltage signal of sufficient amplitude, the Schmitt trigger **28** remains in the position in which the voltage at the output **28***a* of the trigger **28** and at the input **29***a* of the gate **29** is sufficient, together with the voltage at the input **29***b*, to cause the gate **29** to pass a signal to the multivibrator **32**. The state of the multivibrator **32** then changes and thus causes the weaving machine to stop as above. Instead of allowing the optical parts to become so dirty that the weaving machine must be stopped, the multivibrator **32** can of course emit a warning signal when there is slight soiling, so that steps can be taken to clean the optical parts.

If the optical parts are sufficiently clean at this time, the photoelectric cell **23** passes a signal to the Schmitt trigger **28**, the state of which then changes over. The voltage at the input **29***a* of the gate **29** is now insufficient together with the voltage at the input **29***b* to open the gate **29** to deliver a signal so that the multivibrator **32** does not change over and the weaving machine continues to operate. Of course, as the switch **33** is closed, the voltage at the gate input **30***b* is insufficient with the voltage at the input **30***a* to cause the gate **30** to pass a signal to the multivibrator **32**.

The weft yarn stop motion also offers the possibility of monitoring broken weft yarns which, because they are relatively long, remain in the form of a tangle in the scanning zone. If a weft yarn breaks, the part still clamped in the shuttle continues to move towards the catching mechanism **9** and accumulates in the form of a tangle in the region of the beam of light **24**. This tangle is still in the region of the beam of light **24** when the optical parts are checked for dirt. The switching

means react to this condition in the same way as if the optical parts were imperfect or soiled and stop the weaving machine.

Instead of the mechanical switch **33** being actuated by the main shaft of the weaving machine, the voltage required to actuate the weft yarn stop motion can be produced by the shuttle, e.g., its interruption of the beam of light as it passes through the beam can be used to form pulses or a pulse can be generated by induction.

I claim:

1. An optical weft stop motion for a weaving machine comprising

a transmitter for emitting a beam in the direction of a weft; and

a receiver for receiving the beam, said receiver including a switching means having an amplifier for receiving a voltage signal from said receiver, a Schmitt trigger connected to said amplifier for converting said voltage signal into a rectangular signal, a first NAND gate having a first input connected to a first output of said Schmitt trigger and a second input selectively connected to ground or a voltage source, a second NAND gate having a first input connected to a second output of said Schmitt trigger and a second input selectively connected to ground or the voltage source, a switch for selectively connecting said second input of each said NAND gate to ground or the voltage source, a time network connected between said second input of said second NAND gate and said switch, a monostable multivibrator connected to an output of each of said first and second NAND gates for receiving a respective signal therefrom to deactivate a main switch of the weaving machine in response thereto.

2. An optical weft stop motion for a weaving machine comprising

a transmitter for emitting a beam in the direction of a weft; and

a receiver for receiving the beam, said receiver including a switching means having a first means for checking for the presence of a weft in the path of the beam during a weft insertion operation, and a second means for checking the beam intensity of the beam from said transmitter to determine the degree of soiling of said receiver or the presence of a tangled weft after a weft insertion operation and for stopping the operation of the weaving machine in response to said receiver receiving a beam from said transmitter of an intensity less than a predetermined value in the absence of a weft in the path of the beam after a weft insertion operation.

3. An optical system as set forth in claim **2** wherein said switching means is actuated upon movement of a shuttle through the path of the beam.

4. An optical system as set forth in claim **2** wherein said receiver includes a photoelectric cell to receive said beam and said switching means includes means for determining the intensity of light received on said cell in the absence of a weft in the path of the beam whereby a signal is emitted to stop the operation of the weaving machine in response to the intensity of light being less than said predetermined value.

5. An optical weft stop motion for a weaving machine comprising

a transmitter for emitting a beam of light,

a photocell for receiving the beam, and

a switching means connected to said photocell for selectively stopping the operation of the weaving machine in response to said photocell receiving full illumination from the beam during a picking operation and less than a predetermined value of intensity from the beam after completion of a picking operation.